Cal/EPA

California Environmental Protection Agency

Air Resources Board

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December 15, 1997

Pete Wilson
Governor

Peter M. Rooney
Secretary for Environmental Protection

Mr. Ken Kunaniec, Engineering Manager
Bay Area Air Quality Management District
939 Ellis Street
San Francisco, California 94109

Dear Mr. Kunaniec:

Approval of BAAQMD ST-39 as an Alternative to CARB TP-201.5 for Two Vapor Recovery Systems

Thank you for your November 24, 1997 letter in which you asked us to approve the use of ST-39 as an alternative to TP-201.5 when applied to the Gilbarco VaporVac and Dresser WayneVac systems. Based on our analysis of the data you submitted, we are pleased to approve ST-39 as an equivalent method to TP-201.5 for these two systems.

Our evaluation of your ST-39, "Gasoline Dispensing Facilities Air-Vapor to Liquid Volume Ratio," as an alternative test procedure to our TP-201.5, "Determination (by Volume Meter) of Air to Liquid Volume Ratio of Vapor Recovery Systems of Dispensing Facilities," applied the U.S. Environmental Protection Agency (U.S. EPA) Method 301 to the two data sets included with your letter. Table 1 had 21 pairs of data comparing TP-201.5 with ST-39 on a Gilbarco VaporVac system. Table 2 had 24 pairs of data comparing TP-201.5 with ST-39 on a Dresser WayneVac system. The attached two pages titled "Calculating Results" give step-by-step instructions per the U.S. EPA Test Method 301, Section 6.2, Comparison with a Validated Method (June 1996 Revision).

The results of our analysis are given in the two attached tables, Table 1, "Gilbarco VaporVac" and Table 2, "Dresser WayneVac." The VaporVac t-statistic, related to bias, is only 51% of the level requiring a correction factor; and the F-statistic, related to precision, is only 0.6% of the rejection level. The WayneVac statistics look even better with the t-statistic only 41% of the level requiring a correction factor and the F-statistic only 0.1% of the rejection level.

In conclusion, based on the considerations above, we approve the use of ST-39 as an alternative to TP-201.5 when applied to the Gilbarco VaporVac and Dresser WayneVac systems. We would need additional data in order to grant approval of ST-39 for other vapor recovery systems.

If you have questions or comments, please contact James Loop at (916) 263-2059 or Cindy Castronovo at (916) 263-1628.

Sincerely,

William V. Loscutoff, Chief
Monitoring and Laboratory Division

Enclosures

cc: James Morgester, CD
Jim Johnston, Monterey Bay Unified APCD

CALCULATING RESULTS

Results are to be calculated as instructed in EPA Test Method 301 Section 6.2 Comparison with a Validated Method (June 1996 Revision).

1) Determine the standard deviation, SD_d, of the differences, d_i's, of the paired sample differences using Equation 301-6.

$$SD_d = \sqrt{\frac{\sum_i^n \left(d_i - d_m\right)^2}{n-1}} \qquad \text{Eq. 301-6}$$

d_i = The difference between the i-th pair of samples, v_i-p_i (validated - proposed.)
d_i = The mean of the paired sample differences.
n = The number of samples (n = 9)

2) Test the bias for statistical significance by calculating the t-statistic. Determine if the mean of the differences between the proposed method and the validated method is significant at the 80% confidence level.

$$t = \frac{|d_m|}{\frac{SD_d}{\sqrt{n}}} \qquad \text{Eq. 301-7}$$

If t > 1.397 then the bias is statistically significant, and a correction factor is needed.
If t ≤ 1.397 then the bias is not statistically significant, and a correction factor is not needed.

3) Calculation of a Correction Factor (if necessary, see t-statistic test, Eq 301-7).

$$CF = \frac{1}{1 - \frac{d_m}{V_m}} \qquad \text{Eq. 301-8}$$

V_m = The mean of the validated method's data.
Multiply all analytical results by CF to obtain the final values (corrected d_i's for Eq. 301-10).
The data and the proposed method are unacceptable if the correction factor is outside the range of 0.90 to 1.10.

4) Calculate, Sd_v, the standard deviation of the validated method.

$$SD_v = \sqrt{\frac{\sum_i^n \left(v_i - V_m\right)}{n-1}}$$

v_i = The i-th validated sample.

5) Calculate, S_v^2, the variance of the validated method.

$$S_v^{\,2} = \left(SD_v\right)^2 \qquad \text{Eq. 301-9}$$

6) Calculate, S^2_{pooled}, the pooled variance.

$$S^2\,pooled = \frac{\sum_i^n d_i^{\,2}}{2\left(n-1\right)} \qquad \text{Eq. 301-10}$$

If the proposed method has a bias (see t-statistic test Eq. 301.7), all proposed method data points must be multiplied by CF before calculating the d_i's for this calculation.

7) Calculate, S_p^2, the proposed method variance.

$$S_p^{\,2} = 2S^2\,pooled - S_v^{\,2} \qquad \text{Eq. 301-11}$$

** If $S_v^2 > S^2_{pooled}$ let $S_p^2 = S^2_{pooled}/2$.

8) Calculate the F-Test. This determines if the variance of the proposed method is significantly different from that of the validated method.

$$F = \frac{S_p^{\,2}}{S_v^{\,2}} \qquad \text{Eq. 301-12}$$

The critical F value at a 95% confidence level is 3.44.
If F > 3.44, the difference in precision is significant and the proposed method is unacceptable.

Summary of Criteria for Acceptability

1) $0.90 \leq CF \leq 1.10$
2) $F < 3.44$

Table 1, “Gilbarco VaporVac

EPA Method 301 Comparison of ST-39 with TP-201.5

BAAQMD / Gilbarco VaporVac Data

TP-201.5	ST-39										
A/L	(A-V)/L	di	dm	SDd	t	SDv	Sv2	di2	S2poole	Sp2	F
1.16	1.15	0.01	-0.0024	0.0155	0.7057	0.0558	0.0031	0.0001	0.0001	0.0001	0.0197
1.17	1.14	0.03						0.0009			
1.12	1.12	0.00						0.0000			
1.14	1.14	0.00						0.0000			
1.13	1.11	0.02						0.0004			
1.17	1.18	-0.01						0.0001			
1.12	1.13	-0.01						0.0001			
1.15	1.14	0.01						0.0001			
1.16	1.16	0.00						0.0000			
1.11	1.13	-0.02						0.0004			
1.17	1.19	-0.02						0.0004			
1.10	1.12	-0.02						0.0004			
1.12	1.12	0.00						0.0000			
1.12	1.12	0.00						0.0000			
1.10	1.09	0.01						0.0001			
1.00	1.00	0.00						0.0000			
1.04	1.06	-0.02						0.0004			
1.02	1.01	0.01						0.0001			
1.01	1.00	0.01						0.0001			
1.16	1.18	-0.02						0.0004			
1.19	1.22	-0.03						0.0009			

t < 1.397, so a correction factor is not needed

F < 3.44, so the proposed procedure is acceptable

Table 2, “Dresser WayneVac”

EPA Method 301 Comparison of ST-39 with TP-201.5

BAAQMD / Dresser WayneVac Data

TP-201.5	ST-39										
A/L	(A-V)/L	di	dm	SDd	t	SDv	Sv2	di2	S2pooled	Sp2	F
0.95	0.94	0.01	-0.0013	0.0108	0.5692	0.0824	0.0068	0.0001	0.0001	0.0000	0.0043
0.83	0.82	0.01						0.0001			
0.70	0.71	-0.01						0.0001			
0.91	0.91	0.00						0.0000			
0.92	0.92	0.00						0.0000			
0.75	0.77	-0.02						0.0004			
0.67	0.66	0.01						0.0001			
0.92	0.92	0.00						0.0000			
0.90	0.90	0.00						0.0000			
0.86	0.87	-0.01						0.0001			
0.90	0.90	0.00						0.0000			
0.90	0.90	0.00						0.0000			
0.91	0.92	-0.01						0.0001			
0.93	0.92	0.01						0.0001			
0.93	0.93	0.00						0.0000			
0.92	0.93	-0.01						0.0001			
1.03	1.02	0.01						0.0001			
0.91	0.91	0.00						0.0000			
0.96	0.94	0.02						0.0004			
0.91	0.92	-0.01						0.0001			
0.88	0.88	0.00						0.0000			
0.96	0.98	-0.02						0.0004			
0.91	0.90	0.01						0.0001			
0.97	0.99	-0.02						0.0004			

t < 1.397, so a correction factor is not needed

F <0.91 3.44, so the proposed procedure is acceptable